Arduino Based Shadow Alarm with GSM Interface

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***Abstract*— There is a huge buzz about security today and various technologies are combined together to make a network or system, as secure as possible. In this project report, the interfacing of GSM with a Shadow Alarm is illustrated. The objective of this report is to design a circuit which enhances the security feature provided by the shadow alarm and is more efficient than the conventional shadow alarm.**

***Index Terms*—Arduino, shadow alarm, GSM**

I. INTRODUCTION

Presently, security is a necessity and all means and steps are taken forward to make sure everything valuable to us, is always safe and secure. Technology today, plays a huge role to make this possible. Shadow alarm, is one such technological tool, helpful in making our security more robust. Here we design a Shadow Alarm interfaced with a GSM module which sends a pre-defined message to the owner if a shadow is detected. A dimly-lit light is required to be switched on at all times to detect a shadow. This is very helpful to shopkeepers, to protect their valuables in their shops. Also, this can be used by families going out on a trip, to make sure their house is safe. Arduino board is used for implementing the shadow alarm and for the interfacing with GSM. The analog pins of the Arduino board are used to take the input from the LDR, send output to the LED and Siren and also interface with the GSM module through the serial communication ports.

II. BLOCK DIAGRAM

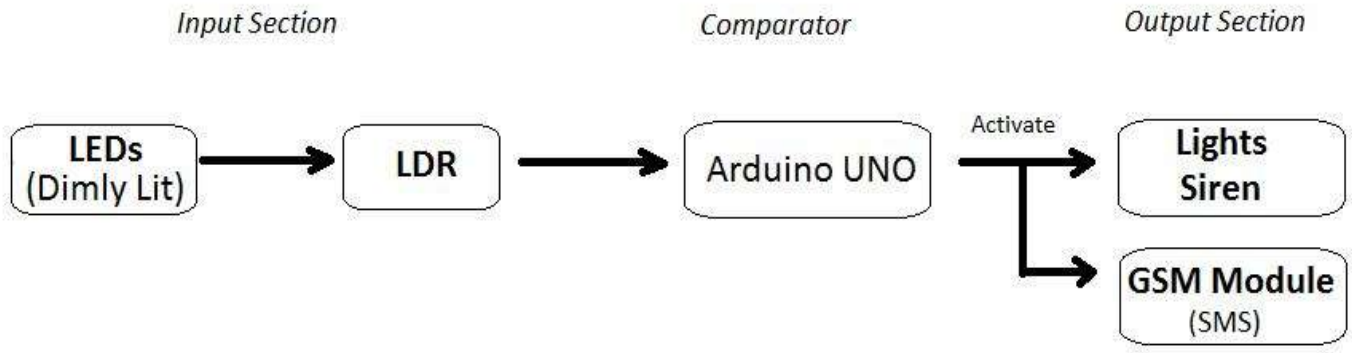

Fig.1. Basic Operation Structure

As shown in Figure 1, the block diagram consists of mainly three sections:

1. The input section: It consists of two parts:
   i. LEDs – The LEDs are used to light the surrounding to a particular limit so as to enable the LDR to detect the shadow. The LEDs can be replaced by lights of any light emitting device.
   ii. LDR – The LDR is the component that is initialized to a reference value and is capable of detecting a shadow.

2. The comparator: The comparator comprises of only the Arduino UNO board. The microcontroller has the reference reading of the LDR stored in it and the LDR constantly records its reading in the UNO kit. The Arduino then compares the received LDR reading with the reference value.

3. The output Section: The output section can be further divided into two parts:

i. Alarm and Siren – As this project has an application of security enhancement, the siren and the alarm are the attention seeking components which enable the neighborhood to know that an unwanted activity has taken place here.

ii. GSM SIM300 – the GSM module is initialized with the mobile number of the owner or the authorized person. If a shadow is detected, the module sends a pre-defined SMS to the given number. For this, the GSM module should be initialized with a GSM enabled SIM card with a unique number.

III. COMPONENT DESCRIPTION

1. Arduino Uno:

Arduino/Genuino Uno is a microcontroller board based on the ATmega328P (datasheet). It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with an AC-to-DC adapter or battery to get started. You can tinker with your UNO without worrying too much about doing something wrong, worst case scenario you can replace the chip for a few dollars and start over again. "Uno" means one in Italian and was chosen to mark the release of Arduino Software (IDE) 1.0. The Uno board and version 1.0 of Arduino Software (IDE) were the reference versions of Arduino, now evolved to newer releases.

Table 1 Specifications of Arduino Uno

Microcontroller	**ATmega328**
Operating Voltage	**5V**
Input Voltage	**7-12V**
Digital IO Pins	**14** (of which 6 can be used for PWM)
Analog Input Pins	**6**
Clock Speed	**16MHz**
DC current per IO pin	**40mA**

2. LDR:

A light-dependent resistor (LDR) or photocell is a light-controlled variable resistor. The resistance of a photoresistor decreases with increasing incident light intensity; in other words, it exhibits photoconductivity. A photoresistor can be applied in light-sensitive detector circuits, and light- and dark-activated switching circuits. A photoresistor is made of a high resistance semiconductor. In the dark, a photoresistor can have a resistance as high as several mega ohms (MΩ), while in the light, a photoresistor can have a resistance as low as a few hundred ohms. If incident light on a photoresistor exceeds a certain frequency, photons absorbed by the semiconductor give bound electrons enough energy to jump into the conduction band. The resulting free electrons (and their hole partners) conduct electricity, thereby lowering resistance.

3. LED:

A light-emitting diode (LED) is a two-lead semiconductor light source that resembles a basic pn-junction diode, except that an LED also emits light. When an LED's anode lead has a voltage that is more positive than its cathode lead by approximately 0.6 to 2.2 Volts, current often flows and light is often emitted. On the other hand, when an LED's anode lead has a voltage that is less positive than its cathode lead by approximately 0.6 to 2.2 Volts, current often does not flow and light is often not emitted.

4. GSM Module – SIM 300:

GSM stands for Global System for Mobile Communications. A GSM Modem is a device that modulates and demodulates the GSM signals and in this particular case 2G signals. The modem we are using is SIMCOM SIM300. It is a Tri-band GSM/GPRS Modem as it can detect and operate at three frequencies (EGSM 900 MHz, DCS 1800 MHz and PCS1900 MHz). Default operating frequencies are EGSM 900MHz and DCS 1800MHz. Sim300 GSM module used here consists of a TTL interface and an RS232 interface. The TTL interface allows us to directly interface with a microcontroller while the RS232 interface includes a MAX232 IC to enable communication with the PC. It also consists of a buzzer, antenna and SIM slot.

IV. WORKING

The whole process can be divided mainly into two parts. The first part is detection of the shadow; the second part being sending the message to the authorized person and ringing the alarm. Now let's consider a situation when an intruder invades into a jewelry shop with this security feature installed. The store is dimly lit and the reference reading of the LDR, for example, is in the range of 500 – 560 units. The LDR is set to pre-defined value of 590 units, by the Arduino UNO, using the Arduino software, to make sure that the circuit is very efficient. During initialization, the mobile number of the owner is coded, to receive the 'Burglar threat' message in case the shadow is detected. After the initialization, the value of the LDR is recorded constantly at a delay of 3 millisecond.

At some point, the burglar would unknowingly place his shadow over the LDR and the reading of the LDR would cross 600 units. At this instant, the condition defined in the Arduino code, would be satisfied, and the circuit would then be activated. The lights in the shop would be switched on, the sirens would start blazing, and the mobile number, which was pre-defined in the code, would receive a message stating the release of a stress signal at his shop.

The initial circuit interfacing can be done as:

1. Input interface: An analog pin of the Arduino board is connected to the LDR and is interfaced. While interfacing, the LDR values are checked and noted for a dimly lit surrounding. The LDR used is a 400ohm to 400k ohm normal resistance variation. The LDR is then set to a predetermined value using the Arduino, according to the surrounding reference values. The LDR continuously monitors the surroundings and takes the readings at a 3 millisecond delay for higher efficiency.

2. GSM interface: The GSM module used here is SIM300 and this interfaced with the Arduino board using the simple TTL interface. It has a very low power consumption of 0.25A and operates at 7 – 15 VAC or DC. It has an adjustable baud rate of 1200 to 115200 bps. For interfacing, the GND pin, the TXD pin and the RXD pin of the GSM module are connected to the GND pin, the RX<–0 and the TX<–0 pins respectively. This is used for establishing the serial communication between the Arduino board and the GSM module.

The practical operation of this project can be explained with the help of a self-explanatory flow chart as shown below:

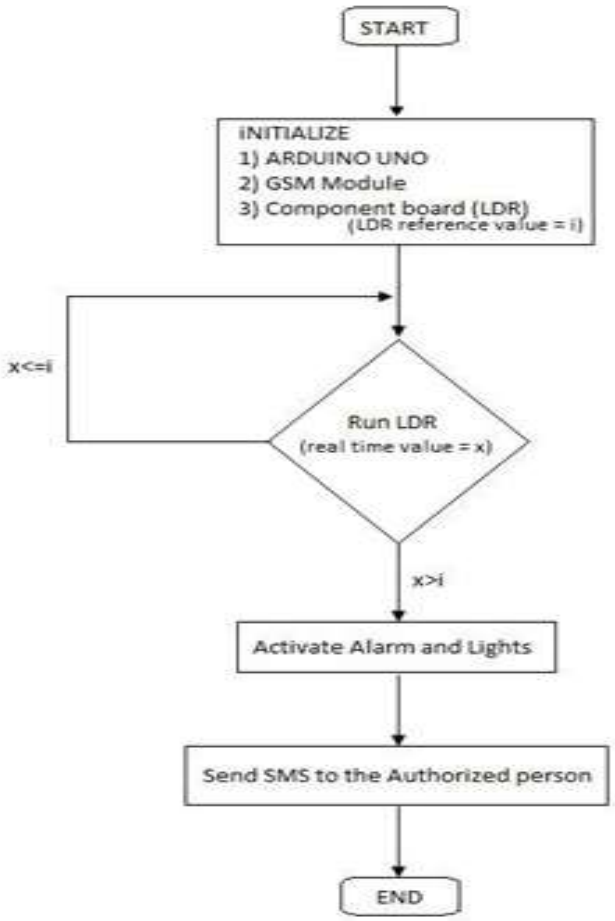

Fig.2. Flowchart of working

V. APPLICATIONS:

1. Useful in shops to make sure the goods are not stolen or tampered with, in the absence of the owner.
2. Useful for domestic purposes as well, where the owner wants to make sure no one enters the house or a particular area of house when they are away.
3. Can be used in companies as well to make sure the employees do not enter a certain area at any point without someone who has the access.
4. If the doors and windows are automated and included in the circuit, they can be shut at the same time the circuit is activated to capture the burglar within the shop and help the law enforcement agency for his quick capture.

VI. CONCLUSION

In this paper we have proposed and implemented an advanced security system using Arduino board and a GSM modem. Using this particular system, an alarm rings on when an intruder invades into a restricted region. By interfacing the arduino with the GSM modem, a SMS is sent to owner of the system. The SMS sent indicates the presence of intruder and can help the owner to take immediate security actions.

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